US-Mexico Workshop:

Application of Innovative Technologies to Water Issues on the Border

San Diego, California, USA

25 - 27 September, 2002

OBJECTIVE

The objective of this workshop was to identify promising topics for bi-national technical collaborations related to water issues on the US-Mexico border and to identify potential US-Mexico teams to address them. Topics are prioritized based upon severity of needs and maturity of potential technology solutions.

FORMAT

The five topical sessions each consisted of two speakers addressing issues such as resource environment, political environment, technology options, and summary bottom line of key needs. Brainstorming ideas and prioritizing topics for collaboration occurred in facilitated discussion periods in each session. Attendees at the workshop included technical staff from US and Mexican research institutions and state and federal agencies from both sides of the border.

SUMMARY

Session 1 considered the problem of saltwater intrusion into coastal aquifers, as well as upward movement of saline water from below inland aquifers. The aquifers in the border region are the principal source of water for irrigation and public water supply. As a result of drought conditions across the border and well into both countries, extraction rates have exceeded recharge rates. This has increased the urgency of the issue.

The overarching need is for total aquifer management, meaning the quantification of how much water can be extracted while continuing to preserve the quantity and quality of available water. Associated costs are also a significant issue. This requires a watershed approach, rather than one defined by political boundaries. However, we are lacking adequate and accurate data to characterize different zones of an aquifer, adequate mechanisms to exchange and manage data amongst the different organizations within a watershed, and holistic watershed models that treat the full groundwater/surfacewater cycle. With a watershed approach, we also will need to establish formal bi-national collaborative measures that account for and manage the asymmetry of resources. Effective implementation of this approach will communicate to policy makers that it is more cost-effective to properly manage existing resources than to pump and import water.

Session 2 explored the technology options for desalination of saline water resources. Mexican researchers have turned to solar-powered desalination because of favorable local conditions, including high levels of solar intensity and an extensive coastal area. They have demonstrated technologies applicable to small communities that can supply water of excellent quality. This has resulted in immediate relief of gastrointestinal illnesses. However, the lack of operating and maintenance instructions and of proper training for members of the communities where the systems have been installed have resulted in the units falling into disuse.

For desalination technologies to be widely deployed, there still are needs to be addressed in the areas of cost reduction, energy reduction, and concentrate disposal. Although technology improvements have reduced the cost of desalination, potable water produced by this means is still more expensive than water acquired from conventional sources. The cost and availability of energy is a major factor in the delivered cost of desalinated water, because desalination, particularly conventional reverse osmosis, is very energy-intensive. Materials or capital cost is another issue. This can be addressed by innovative design approaches.

There are some environmental issues related to desalination that can be addressed through technology. Disposal of brackish water reject into the ocean does not appear to have any adverse impacts, but there are clearly limitations to the amount that can be accommodated. For inland desalination sites, disposal of the concentrate or brine is a much more difficult issue. There may be innovative, alternate uses for the brackish discharge, as well as for non-potable desalinated water that can make the technology attractive to install. Emissions from the fuel source are another environmental concern. It will be very hard to solve all desalination needs with only one technology; multiple technology paths are needed.

A key lesson learned is that a local needs assessment that will help invest the community in the desalination project is important to the long-term viability of the project. There are many abandoned projects where the government installed a facility, but never asked the community if they wanted it. The absence of the social infrastructure to maintain and operate the facility is another reason for project failure. Either training or low- or no-maintenance technologies are needed to address this problem. The needs assessment may also lead to the installation of distributed rather than centralized systems. If the needs assessment is not performed and the issues it raises not addressed, communities will find it cheaper to bring in fresh water than to power and maintain the desalination facility.

Session 3 addressed water needs for agriculture. A number of relevant issues were raised: efficient water use, evaporation suppression, wastewater management at dairy farms, and assurance that products crossing the border are free of pathogens.

A protected agriculture project in Mexico that started one year ago already has 150 greenhouses in operation. These simple greenhouses do not require heaters or ventilators, and they are equipped with sensors and computers to optimize irrigation efficiency. This project has reported the capability to produce one ton of fodder in the greenhouse using 1000 – 1200 liters of water. In contrast, the traditional agricultural approach for one ton of alfalfa uses 1.2 – 1.4 million liters.

There is also an opportunity to improve the efficiency of conventional agriculture. Farmers want to know how much water to apply for irrigation, when water should be applied, what types of fertilizer to use, how much fertilizer to apply, and proper design for irrigation. Lack of understanding has resulted in overuse of water and fertilizers and produced contamination of aquifers. Education and training, including the development of manuals, are needed.

Session 4 dealt with a host of wastewater treatment and reuse issues, including: biotechnology for pollution prevention and environmental remediation; unique needs of decentralized treatment; safety and health issues connected to the use of wastewater to irrigate, including the presence of pharmaceuticals in the water; regulatory differences between the U.S. and Mexico; and the pressing need for pretreatment of industrial wastewater. The session also addressed the need to take creative advantage of local conditions, such as temperature and solar intensity, when considering technical solutions.

In this topical area, the integration of technical, economic, social, regulatory and political factors really came to the forefront. Major findings are all along these lines.

Socio-economic-political drivers: The need is to get new technologies accepted throughout the entire pipeline, from funding agencies to manufacturers to communities. Design of every project should include a strong socio-economic research component (paralleling the technical component). Local needs assessment must be performed in an integrated manner with the technical approaches since application of technology will never work without social acceptance. This includes “knowledge transfer” so that understanding of how to operate and maintain systems is transferred to the community, as well as the development of ‘appropriate’ technologies such as decentralized systems, and systems that are easy to operate and have high reliability.

Harmonization of standards: Regulatory issues are complex when technology needs and funding sources are coming from both countries. Note that the federal regulations may be different from state regulations, and state and federal regulations differ on the two sides of the border. The first step is to see whether the variation in standards has much impact on what is needed. For example, addressing the lack of centralized treatment in the colonias requires looking more broadly because what is being done in the colonias impacts bigger cities.

Cost: Reality in Mexico and the U.S. is that money is becoming tighter. In the past, the government had financed all infrastructure. Mexico’s CNA does not now have enough money available, and neither does the U.S. EPA. Technology developers must tailor proposals and systems to the changing financial environment and trend toward privitization. This requires approaches with low operating and capital costs. The end-payer is the user, and the user requires cost-effective solutions.

Session 5, concerning arsenic contamination in drinking water, provided an example of international regulatory and priority differences. The U.S. implementation deadline is 2006 for compliance with 10 ppb arsenic in drinking water. By comparison, the European Union deadline is 2003. Mexico is going down to 25ppb, and the change will be implemented in steps. Arsenic as an issue has a different priority in Mexico than in the U.S. The culture in Mexico, even amongst very poorest (50 pesos a week salary), is to purchase bottled water. It would be difficult to convince people that they could drink the water out of the tap!

Some technology needs include residuals management and disposal; cost for installation, operating, and maintenance; water chemistry decision tools to help decision makers understand how to select treatment technologies that will most economically meet their needs; laboratory analysis capabilities; and data collection and dissemination mechanisms. Once again, the point was made that acceptance of new technologies includes acceptance by funding entities, regulatory agencies, and communities.

OVERARCHING ISSUES AND NEXT STEPS

Overarching issues that came up again and again in the workshop discussions provide a framework that will be used to guide priorities for future partnerships.

1. Data sharing and cooperative processes are required across the border:
   - Watersheds know no political boundaries.
   - Accurate and adequate data sets are lacking.
   - Common analysis methodologies are critical to implementing joint (regional) solutions.
2. Socio-economic analysis is integral to technology development:
   - Get communities invested and provide them with education and training.
   - Get new technologies accepted by funding entities (public and private) and by regulators. Political factors sometimes outweigh technical logic.
3. Bi-national technology solutions require bi-national funding and a "map" to negotiate the paperwork maze.
4. Multiple technology paths are required to solve the diversity of water problems.

Workshop participants are enthusiastic about collaborating to develop and apply innovative technology solutions to water issues on the border. Specialized technical expertise and implementation know-how exist on both sides of the border, and combining these skills will greatly improve our ability to bring solutions to high-priority problems.

Next Steps revolve around establishing a bi-national research, development, and technology application program. In all five sessions, ideas surfaced for bi-national partnerships to develop technology that could meet these needs. Bi-national technical teams are developing white papers detailing collaborative ideas for greenhouse technology, solar stills, geophysical survey techniques, water and wastewater management and reuse, and next-generation desalination technology.